THE VALUE OF THE DIFFERENTIAL LEUCOCYTE COUNT IN ACUTE APPENDICITIS.

BY ALFRED H. NOEHREN, M.D.,
OF NEW YORK.
Interne at German Hospital.

THE question of the value of blood examination in acute abdominal conditions is still the subject of much difference of opinion. The principal reason for this is that the statistics so far collected and published on this subject are few and therefore no definite conclusions have been reached. If it can be demonstrated that blood examination is an aid in deciding doubtful cases and in determining indication for immediate operative intervention, its value to the surgeon becomes very great.

To furnish additional data on this question is the purpose of this paper. It is based on 72 cases of Appendicitis and its sequelae in which a blood examination was made just previous to operation, so that the result of the examination can be compared with the actual condition present. The cases are from the services of Drs. Kammerer, Kiliani, and Willy Meyer at the German Hospital, New York.

The findings at operation have been divided into 5 classes:

1. Diffuse Peritonitis (D.P.)—Free pus in the greater part of the peritoneal cavity.

2. Spreading Peritonitis (S.P.)—Free pus in a limited portion of the abdomen, but not walled off by adhesions.

3. Gangrenous Appendicitis (G.A.)—Appendix gangrenous to greater or less extent, not walled off by adhesions.

4. Inflamed Appendix (I.A.)—Appendix inflamed, no gangrene, no perforation, no adhesions around it. Empyema of appendix without gangrene is included in this class.

5. Abscess (A.)—Pus outside of appendix, but walled off by adhesions from the remainder of the peritoneal cavity.

When blood examination in acute surgical conditions first came into practice, the amount of leucocytosis only was considered. An increased number of leucocytes meant the presence of inflammation or of pus, an increasing leucocytosis meant extension of the process, an absence of leucocytosis above 10,000 signified a mild process.

In 69 cases of this series, the leucocyte count and the conditions found at operation were as follows:

	D.P.	S.P.	G.A.	I.A.	A.	Total
Under 10,000	—	—	2	2	3	7
10,000–15,000	5	1	2	8	8	24
15,000–20,000	3	1	3	7	7	21
20,000–25,000	2	1	1	1	4	9
Over 25,000	2	1	3	—	2	8
						69

A study of this table shows that a leucocytosis above 10,000 may mean anything from a general peritonitis to a simple inflamed appendix or encapsulated abscess. A leucocyte count alone, therefore, is of no aid in diagnosing the severity of the condition or the necessity of immediate operation.

Dr. Frederick E. Sondern, who has done much work along this line, attaches great value to the differential leucocyte count as an aid in diagnosing the severity as well as the presence of intra-abdominal conditions. He says:[1] "The increase in the relative number of polynuclear cells is an indication of the severity of the toxic absorption, and the degree of leucocytosis is an evidence of the body resistance toward the infection. . . . Purulent exudates were rarely, if ever, present with low polynuclear percentages, irrespective of the height of the leucocyte count, while very high polynuclear percentages almost invariably indicated their presence, even if the total leucocyte count was low."

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[1] "The Value of the Differential Leucocyte Count in Diagnosis," Am. Journal of Medical Sciences, Dec., 1906.

The body resistance, which Dr. Sondern says is measured by the degree of leucocytosis, we can disregard for our purpose. It is of little importance in the question of deciding for operation in surgical conditions, because, if these conditions are present, operation must usually be done.

On the other hand, the severity of infection is a very important point in deciding whether operation is necessary at once, or can safely be postponed. If the percentage of polynuclears is an index of the severity of the process, it ought to be a very important aid to the surgeon.

In 60 cases, in which a differential count was made, the results and findings were as follows:

	D.P.	S.P.	G.A.	I.A.	A.	Total
Over 90 per cent.	3	1	3	1	—	8
85-90 "	6	—	2	5	6	19
80-85 "	2	1	3	2	4	12
75-80 "			2	5	6	13
Under 75 "				4	4	8
						60

We see from the above that in every case with 90 or more per cent. of polynuclears, immediate operation was surely indicated, except in one, and even in that case there was an acute inflammation of the appendix. Every case under 80 per cent. could probably wait, being either an encapsulated abscess or a simple inflamed appendix, except in two cases of gangrenous appendix, both of which had 78 per cent.

These figures would make us conclude that every case of appendicitis with 90 per cent. or more of polynuclears needs immediate operation, whereas every case under 78 per cent. can safely wait for further developments.

Let us take the cases between these two extremes and tabulate them in detail.

	D.P.	S.P.	G.A.	I.A.	A.
78 per cent.	—	—	2	—	—
79 "	—	—	—	1	4
80 "	—	—	1	3	2
81 "	—	—	—	—	1
82 "	—	1	1	—	—
83 "	2	—	1	—	—
84 "	—	—	—	—	1
85 "	—	1	1	1	3
86 "	3	—	—	—	1
87 "	1	—	—	1	2
89 "	1	—	1	2	1

The cases of peritonitis are grouped among the higher percentages, but the other conditions are about equally distributed.

Our conclusions then would be: a percentage of 90 or more of polynuclears indicates a very severe process that needs immediate intervention; a percentage below 78 indicates a mild or "safe" process in which immediate operation is not necessarily indicated; between these two, the higher the percentage the more likely is the process to be a severe one, without, however, excluding the possibility of a mild or safe process.

Another phase of this subject is presented by Dr. Chas. L. Gibson.[2] He emphasizes "the relative disproportion of the polynuclear percentage to the total leucocytosis" as being more reliable than the leucocyte count alone or the polynuclear percentage alone. He says: "It (this relative disproportion) is of value chiefly in indicating fairly consistently the existence of suppuration or gangrene. . . . The greater the disproportion, the surer are the findings, and in extreme disproportions the method is practically infallible."

He suggests the use of a standard chart in which a base-line represents 10,000 leucocytes at its left extremity and 75 per cent. polynuclears at its right extremity. Every centimetre above the base-line represents 1000 additional leucocytes and 1 per cent. increase in the polynuclears. For instance, for a case with 16,000 leucocytes and 88 per cent. polynuclears, a dot is made at the left 6 cm. above the base-line and at the right 13 cm. above the base-line. The two are then connected by a straight line, which in this case would be a rising one from left to right.

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[2] "The Value of the Differential Leucocyte Count in Acute Surgical Conditions," ANNALS OF SURGERY, April, 1906.

In 20 cases of acute appendicitis he found a rising line, in 2 cases it was horizontal, in 3 cases it had a downward tendency. He says: "All the severe lesions, those with gangrene of the appendix or progressive peritonitis, showed a rising line, while all the cases indicated by a falling line were distinctly mild types, such as well defined safe abscesses."

Let us see how our cases bear out this statement. In 52 cases in which both a leucocyte count and an estimation of the polynuclear percentage was made, the results were as follows:

	D.P.	S.P.	G.A.	I.A.	A.	Total
Rising line	7	1	4	7	4	23
Horizontal line	2	—	1	1	2	6
Falling line	2	2	4	5	10	23
						52

Although the majority of our cases bear out Dr. Gibson's statement, there are so many exceptions that it hardly seems of much value to the surgeon. Thus, of 14 cases of diffuse or spreading peritonitis, 6 showed either a horizontal or a falling line, and, judged by the "standard chart," would be "mild" cases.

In addition to the above cases, one other deserves mention. The patient had symptoms suggestive of a spreading peritonitis following appendicitis. Blood examination: 20,200 leucocytes, 86 per cent. polynuclears, almost a horizontal line by the "standard chart." At operation a ruptured ectopic pregnancy was found with blood clots in the peritoneal cavity. Immediate operation was clearly indicated.

A study of the above tables shows that of the three methods of blood examination described, estimation of the number of leucocytes alone, the percentage of polynuclears alone, and the relative disproportion between the two, the second is the most reliable. Not only is it the most reliable, but it is of positive value in diagnosing the severity of abdominal conditions and deciding the question of immediate operation.

Furthermore, as the estimation of the polynuclear percentage is a very simple procedure, requiring only glass slides, a stain, and a microscope, and can be more quickly and easily done than the counting of the leucocytes, it should not be neglected in any acute case of appendicitis. If it results in one of the absolute percentages, 90 per cent. or above, 78 per cent or below, it alone can be relied upon in determining immediate operative interference. If it lies between these two, it will add just so much to the physical signs and history, according as it approaches the one or the other extreme.

I will cite just one case out of many where it practically determined the diagnosis of the severity of the condition.

Man admitted to hospital with history of one previous attack. Two days before admission had sharp pain in upper part of abdomen with vomiting. Next day pain localized in lower right quadrant. Physical examination showed marked tenderness and rigidity of lower half of right rectus muscle, but with an indefinite feeling of a mass. Slight tenderness and rigidity of lower half of left rectus muscle. Leucocytes, 14,800; per cent. of polynuclears, 87.

Here was a case in which it was difficult to make a diagnosis between spreading peritonitis and beginning abscess formation. But 87 per cent. of polynuclears in this case, according to our findings above, would speak for the severer process. Operation was done immediately and a gangrenous appendix with free fluid in the peritoneal cavity was found.

CONCLUSIONS.

1. Blood examination in cases of acute appendicitis is of great value in determining the severity of the condition and therefore deciding whether or not immediate operative interference is indicated.

2. The degree of leucocytosis, formerly considered an important diagnostic aid, is too variable to be of any practical value.

3. The relative disproportion between the percentage of polynuclears and the degree of leucocytosis is reliable in a majority of cases, but the number of exceptions is so great that its practical value in determining immediate operation becomes very small.

4. The estimation of the percentage of polynuclears alone is more reliable than either of the preceding methods and therefore, together with the fact that it is the one most easily made, the method to be recommended.

5. A polynuclear percentage of 90 per cent. or more indicates a severe process that needs immediate operative interference; a percentage below 78 per cent. means a "safe" or mild process; a percentage between the two extremes speaks for the one condition or the other according as it approaches the one extreme or the other.